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**Bulk Shielding Facility
Quarterly Report
January, February, and
March 1986**

T. P. Hamrick
F. E. Muggridge

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Operations Division
Reactor Operations Section

**BULK SHIELDING FACILITY QUARTERLY REPORT
JANUARY, FEBRUARY, AND MARCH 1986**

T. P. Hamrick
F. E. Muggridge

SPONSOR: J. H. Swanks
Operations Division

Notice: This document contains information of a preliminary nature. It is subject to revision or correction and, therefore, does not represent a final report.

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**BULK SHIELDING FACILITY QUARTERLY REPORT
JANUARY, FEBRUARY, AND MARCH 1986**

SUMMARY

The BSR operated at an average power level of 958 kW for 6.9% of the time during January, February, and March. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory.

The PCA is shutdown for shim-safety rod magnets and associated electronic components upgrading.

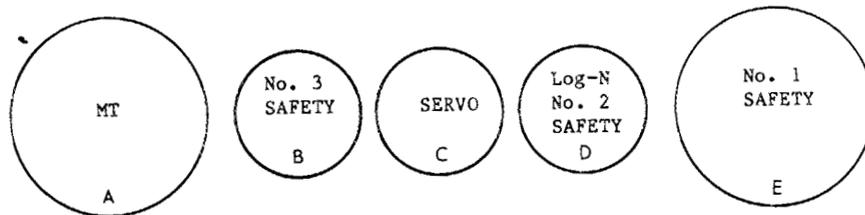
BULK SHIELDING FACILITY

OPERATIONS

The BSR remained down for most of the quarter due to no request to operate. The brief period of operation was used for personnel training, sample irradiation, functional testing, and training of two university student groups.

The preliminary work for the National Low-Temperature Neutron Irradiation Facility (NLTNIF) installation continued.

Core loading 102 is shown in Fig. 1.



				FC	Al Can	Al Can	Al Can	Al Can
81	82	83	84	85	86	87	88	89
				Al Can	Al Can	Al Can	Al Can	Al Can
71	72	73	74	75	76	77	78	79
		EAST		OR-98-F 200	BSF-S-17 64	BSF-A10 188	BSF-S-18 65	BSF-A9 178
61	62	63	64	65	66	67	68	69
		D ₂ O		BSF-T6 218	M-111-F 180	YZP-0049 204	BSF-T2 182	BSF-T5 215
51	52	53	54	55	56	57	58	59
		TANK		BSF-S-T2 110	BSF-T1 173	BSF-S-T4 109	BSF-T3 198	Al Plug ^a
41	42	43	44	45	46	47	48	49
				M-110-F 181	M-59-H 202	M-102-F 198	M-104-F 202	BSF-T4 216
31	32	33	34	35	36	37	38	39
				M-60-H 187	BSF-S-T1 85	M-95-F 185	BSF-S-T3 85	M-61-H 189
21	22	23	24	25	26	27	28	29
				Al Plug	Al Plug	Al Plug	Al Plug	Al Plug
11	12	13	14	15	16	17	18	19

^aCore position for the National Low-Temperature Neutron Irradiation Facility.

BSR CORE

LOADING NO	102
DATE	March 21, 1985
EXCESS REACTIVITY	4.95% Δk/k
OPERATING MASS	4014 g

ROD POSITIONS AT CRITICAL (With Operating Mass)

ROD NO.	IN. WITHDRAWN	
1	9.09	10.88
2	9.09	10.88
3	9.09	10.88
4	9.09	10.88
5	23.00	10.88
6	23.00	10.88

REMARKS:

Rod calibrations made at 4 kW and core flow ~1000 gpm.

Fig. 1. Core loading 102, BSR.

Table 1. Basic operating data
(January-March 1986)

	This quarter	Last quarter	Year to date
Total energy, kWd	5945	1162	5,945
Average operating power, kW	958	364	958
Time operating, %	6.9	3.6	6.9
Reactor availability, %	99.9	99.9	99.9
Reactor water radioactivity, cpm/ml (av)	1,268	BG	1,268
Reactor water resistivity, ohm-cm (av)	2,032,000	1,871,000	2,032,000
Research samples	3	4	3

Shutdowns

The reactor experienced thirty scheduled shutdowns during the quarter. There were no unscheduled shutdowns during the quarter. Table 2 gives an analysis of the scheduled shutdowns.

Maintenance and Changes

Maintenance and changes to the instrumentation components in the complex are listed in Table 3.

Maintenance and changes of the process systems are listed in Table 4.

Maintenance and changes of the mechanical systems are listed in Table 5.

Table 2. Analysis of shutdowns

Description of shutdown	Number	Downtime (h)
<u>Scheduled</u>		
Experimenters:		
NLTNIF samples	1	77.742
Other samples	2	189.942
Maintenance:		
Functional systems checks	6	822.263
Quarterly checks	1	160.000
Reactor Operations:		
University student groups (UT and MSU)	6	273.000
Training	<u>14</u>	<u>488.152</u>
Subtotal:	30	2011.099
<u>Unscheduled</u>		
Experimenters:	0	0
Reactor Operations:	<u>0</u>	<u>0</u>
Subtotal:	0	0
TOTAL:	<u>30</u>	<u>2011.099</u>

Table 3. Maintenance and changes, instrumentation and controls

Date	Components	Trouble/change	Maintenance Performed
1-3-86	Pool high level alarm	New	Installed to provide early warning of increase in pool water level
1-8-86 thru 1-9-86	Servo controller	Heat-power value in error	Replaced servo controller
1-9-86	Pool water level alarm	Obstructs bridge	Moved to new location
1-13-86	Servo controller	Failure	Mis-match on maintenance ribbon connector
1-15-86	No. 3 safety chamber	Failure	Replaced old chamber
1-16-86	No. 1 shim safety rod	Dropped	Dropped during startup checks
1-16-86	Nos. 1, 2, and 5 shim safety rods	Dropped	Gain adjustment on the No. 3 shim-safety rod amplifier
1-16-86	Servo controller	Failed	Would not control above 5% N _f . Repairs made
1-17-86	No. 3 sigma amplifier	Routine	Recalibrated
1-21-86	Servo controller	Failed	Repaired and loaded program
1-22-86	No. 3 safety channel	Routine	Adjusted gain setting
1-29-86 thru 1-30-86	Count rate channel	Noise	Cleaned cable connectors
1-31-86	Log-N recorder	Pen failed to move	Recorder pen drive mechanism was lubricated

Table 3. (Continued)

Date	Components	Trouble/change	Maintenance Performed
2-7-86	Log-N period recorder	Pen failed	Cleaned
2-12-86	No. 3 safety channel	Routine	Calibrated
2-19-86	Resistivity meter	Failure	Replaced failed instrument
2-20-86 thru 3-11-86	Count rate period recorder	Erratic	Replaced pre-amplifier
3-11-86 thru 3-12-86	No. 3 safety channel	Set point drifts	Made adjustments due to fluctuation
3-11-86 thru 3-17-86	Regulating rod limit switch	Failed	Replaced
3-12-86	Nos. 1, 2, and 3 safety channels	Set point drifts	Functionally tested and made adjustments
3-12-86 thru 3-13-86	Remote TV	Failed - no picture	Iris adjusted
3-17-86 thru 3-21-86	Instruments	Routine	Quarterly checks
3-18-86	No. 3 safety channel	Failed	Replaced amplifier
3-20-86	Fission chamber	New	Installed from instrument bridge for shielding experiment

Table 4. Maintenance and changes, process systems

Date	Components	Trouble/change	Maintenance Performed
1-17-86	Pool room overhead lamps	Routine	Relamped
1-20-86	BSF roof	Leaks	Repaired a 20 ft roofing split
2-3-86 thru 2-5-86	NOG	Routine	Isolated header for system maintenance
2-5-86	BSF roof	Leaks	Repaired leak at north center column
2-8-86	Cell vent	Routine	Removed from service to do maintenance then returned to service
3-11-86	Cell vent backup blower	Routine	Complete alterations
3-19-86	Overhead crane	Erratic movement	Serviced switch and brake

Table 5. Maintenance and changes, mechanical system

Date	Components	Trouble/change	Maintenance Performed
1-15-86	South personnel door	Lock failed	Repaired lock
1-27-86 thru 1-28-86	No. 5 shim-safety rod clutch switch	Failed	Cleaned and placed back into service
2-3-86	Emergency light	Failed - battery low	Light was replaced with a new model
2-7-86	No. 1 shim-safety rod clutch switch	Failed	Recovered by adjusting
2-20-86	CAMs	Routine	Bimonthly functional checks
3-5-86	Demineralizer pump	Leak	Attached drip pan and line to remove water to process drain
3-12-86	No. 5 shim-safety rod clutch switch	Failed	Replaced clutch switch and leads
3-13-86	Fission chamber raise-lower switch	Failed	Replaced switch
3-14-86 thru 3-17-86	No. 3 shim-safety rod seat switch	Failed	Replaced seat switch
3-19-86	No. 1 shim-safety rod clutch switch	Malfunction	Cleaned switch and rod armatures
3-19-86 thru 3-10-86	Obsolete equipment	Obsolete	Removed all valves and electrical equipment from instrument bridge

Operational Activities

The operational activities for the quarter are listed in Table 6.

Table 6. Operational activities

Date	Remarks
1-7-86	Transferred sample 85-12-3 from west pool storage to lead bucket, sample 85-12-4 from ATNIF to the west pool storage, and sample 85-12-5 into ATNIF for irradiation
1-15-86	Transferred sample 85-12-5 from ATNIF to west pool storage
1-22-86	Loaded sample 86-01-01 into ATNIF for irradiation
1-27-86 thru 1-31-86	UT student training: approach to critical and shim safety rod calibration
2-5-86	Completed FRCAS quarterly test
2-12-86 thru 2-13-86	Installed wet sample holder in CP-17, loaded boron bucket, and made reactivity and thermal measurements
2-19-86	Loaded Ra-B source into LITR carrier for shipment to the ORR
2-22-86 thru 2-24-86	Shut down facility for scheduled power outage
3-1-86 thru 3-3-86	Shut down facility for scheduled power outage
3-5-86	Returned the Ra-B source to the pool for storage
3-13-86	Made annual subcritical test on core 102
3-18-86	Moved breeder reactor fission chamber from pool to PCA control room, D ₂ O tank north and secured adjacent PCA fuel rack, and HSST shields to west pool floor for storage
3-19-86	Moved CP-17 wet holder to west pool wall and placed aluminum plug in CP-17
3-20-86	Completed the cell vent quarterly checks
3-24-86 thru 3-27-86	Conducted MSU student training: approach to critical, shim-safety rod calibration, shielding experiment, and xenon experiment
3-31-86	Transferred breeder reactor fission chamber to ORR vault

Experiments

Work relating to the National Low-Temperature Neutron Irradiation Facility, NLTNIF, is listed in Table 7.

Table 7. Experiment facilities activity, NLTNIF

Date	Remarks
1-7-86	Sample 85-12-5 equipped with thermocouples to measure actual temperatures
1-9-86	Installed zircoloy shield storage rack in pool and placed shield in rack for storage
1-20-86	Loaded cryostat insert, using overhead crane
2-10-86 thru 2-11-86	Installed underwater dewar (100-L capacity) near southwest pool corner
3-20-86	Installed NLTNIF work platform at pool southeast corner

Fuel

Changes in the fuel inventory are reported in Table 8.

Experiment Facilities Assignments

Experiment facilities assignments are listed in Table 9. The tubes of the east D₂O tank are not permanently assigned; they have been used by various Laboratory personnel for short-term sample irradiations.

Table 8. Fuel and shim-safety rod status

	This quarter	Last quarter	Year to date
Fuel elements depleted	0	0	0
Shim-safety rod fuel elements depleted	0	0	0
New fuel elements placed in service	0	0	0
New shim-safety rod fuel elements placed in service	0	0	0
Partially depleted shim-safety rod fuel elements	6	6	6
New fuel elements available for use	1	1	1
New shim-safety rod fuel elements available	7	7	7
Partially depleted fuel elements available for use (includes core)	28	28	28
New boron stainless steel shim-safety rods placed in service	0	0	0
Boron stainless steel shim-safety rods in service	6	6	6
Boron stainless steel shim-safety rods available for use	1	1	1

Table 9. Experiment facilities assignments

Facility	Location	Division or sponsor
Dry thermal-neutron tubes (D-3-1 and -2)	East D ₂ O tank	Operations
Wet thermal-neutron tubes (D-4-1 and -2, D-6-1, -2, -3, -4, and -5)	East D ₂ O tank	Operations
National Low-Temperature Neutron Irradiation Facility ^a (NLTNIF)	Southwest corner of pool	Solid State

^aConstruction in progress.

Demineralizer Performance

Table 10 gives detailed information on the condition of the primary water system for the preceding year and pertinent data on the performance of the bypass demineralizer.

SUMMARY OF SURVEILLANCE TESTS AT THE BSR

Table 11 is a tabulation of the completion dates of the surveillance tests required by the Technical Specifications. This table contains all the surveillance tests scheduled for frequencies of one test per month or longer. Other surveillance requirements which are not reported are satisfied by routine completion of daily and weekly check sheets, start-up checklists, hourly data sheets, the operating log book, and miscellaneous quality assurance tests.

Table 10. Demineralizer performance data

Run No.	Initiation date	Termination date	Throughput (gal)	Gross gamma (cpm/ml)		pH		Specific resistance (ohm-cm)	
				In	Out	In	Out	In	Out
57	11-20-79	4-8-80	2,750,000	1,866	134	5.3	5.5	1,084,000	2,038,000
58	4-9-80	5-29-80	1,000,000	1,979	123	5.3	5.5	808,000	1,832,000
59	5-30-80	6-2-80	5,000	1,950	125	5.3	5.6	774,000	1,538,000
60 ^a	6-3-80	8-4-80	1,750,000	1,929	106	5.4	5.6	1,278,000	3,466,000
61	8-5-80	10-30-80	1,850,000	1,824	118	5.4	5.6	1,148,000	2,600,000
62	11-4-80	2-26-81	2,600,000	1,587	110	5.4	5.6	1,368,000	4,319,000
63	3-2-81	6-20-81	2,200,000	1,271	151	5.5	5.7	1,233,000	3,960,000
64	6-29-81	8-11-81	1,250,000	1,941	141	5.4	5.7	896,000	2,258,000
65	8-12-81	9-8-81	425,000	2,163	142	5.2	5.4	445,000	1,126,000
66 ^a	9-19-81	1-3-82	850,000	1,666	119	5.4	5.6	1,138,000	1,980,000
67	1-4-82	4-5-82	2,400,000	1,874	150	5.4	5.6	970,000	1,691,000
68	4-7-82	7-8-82	2,000,000	1,841	138	5.3	5.5	915,000	1,841,000
69	7-9-82	7-27-82	750,000	1,962	129	5.2	5.4	720,000	1,136,000
70 ^a	9-22-84	8-30-83	1,900,000	527	59	5.2	5.4	1,180,000	2,034,000
71 ^b	8-31-83	5-15-84	2,693,560	2,961	166	5.6	5.8	1,030,000	1,830,000
72	6-5-84	9-11-84	2,851,200	--	--	5.5	5.7	1,025,000	2,000,000
73	9-13-84	2-8-85	2,650,000	2,467	230	5.6	5.9	758,000	1,289,000
74	2-16-85	4-1-85	1,114,560	2,565	--	5.6	6.1	468,000	1,501,000
75 ^a	4-2-85	7-16-85	3,389,760	3,337	282	5.7	6.1	736,000	1,590,000
76	7-19-85	12-6-85	4,354,460	3,727	196	5.7	5.9	840,000	1,818,000
77	12-10-85	4-9-86	3,543,400	1,268	104	5.7	5.8	1,023,000	2,033,000
78	4-11-85	--	--	--	--	--	--	--	--

^aNew resin in the demineralizer columns.

^bThe demineralizer operated on low flow (approximately 7 gpm) from September 26, 1983, to January 17, 1984, due to a failure of the booster pump.

Table 11. Summary of surveillance tests at the BSR

Test	Most recent test	Previous test
<u>Biennial tests</u>		
Inspection of the shim-safety rods	9-23-85	8-28-84
<u>Annual tests</u>		
Core ΔT channel calibration	3-21-86	9-17-85
Primary coolant flow channel calibration	9-17-85	12-13-84
Pool water-level channel calibration	3-20-86	10-1-85
Maximum rate of reactivity addition by the shim-safety rods	3-20-86	12-12-85
Reactivity assigned to the servo-control system	3-22-85	12-13-84
Subcriticality with each shim-safety rod at its upper limit while all other shim-safety rods are fully inserted	3-13-86	6-7-85
<u>Semiannual</u>		
Cell-ventilation filter efficiency		
A. Elemental iodine	12-19-85	9-26-85
B. Dioctyl phthalate	12-19-85	9-26-85
Radiation monitoring equipment calibration	2-28-86	12-2-85
Stack radiation monitor calibration	10-8-85	6-6-85
<u>Quarterly</u>		
Safety channel No. 1 calibration	3-18-86	12-11-85
Safety channel No. 2 calibration	3-18-86	12-11-85
Safety channel No. 3 calibration	3-18-86	12-11-85
Log-N channel calibration	3-18-86	12-11-85

Table 11. (Continued)

Test	Most recent test	Previous test
<u>Quarterly (continued)</u>		
Fission chamber channel calibration	3-18-86	12-11-85
Flapper valve position channel functional test	3-20-86	12-19-85
Measurement of release time and time of flight for the shim-safety rods	3-20-86	12-12-85
Containment closure system functional test	3-20-86	12-18-85
In-leakage during containment mode	3-20-86	12-18-85
<u>Others</u>		
Calibration of shim-safety rods	3-22-85	9-12-83
Pool water level high	1-3-86	--

POOL CRITICAL ASSEMBLY

OPERATIONS

The Pool Critical Assembly (PCA) is shutdown for shim-safety rod magnets and associated electronic components upgrading. The operational activities for the quarter are listed in Table 12.

Table 12. Summary of PCA operational activities

Date	Remarks
2-24-86	Pulled up each of the 35 PCA fuel elements and measured the gamma activity

MAINTENANCE AND CHANGES

PCA maintenance activities are reported in Table 13.

Table 13. Summary of PCA maintenance activities

Date	Remarks
2-13-86	Replaced broken hasp on control room door

SURVEILLANCE TESTS AT THE PCA

Shim-safety rod magnets and associated electronic components are being upgraded at the PCA. Until this work is completed, it will not be possible to make all the surveillance tests required at this facility by the Technical Specifications. Thus, a waiver of the PCA Technical Specifications surveillance test requirements during the proposed modification and component replacement period was granted.¹

¹Letter to B. L. Corbett from K. H. Poteet, subject "Waiver of Surveillance Tests at the PCA," March 26, 1985.

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